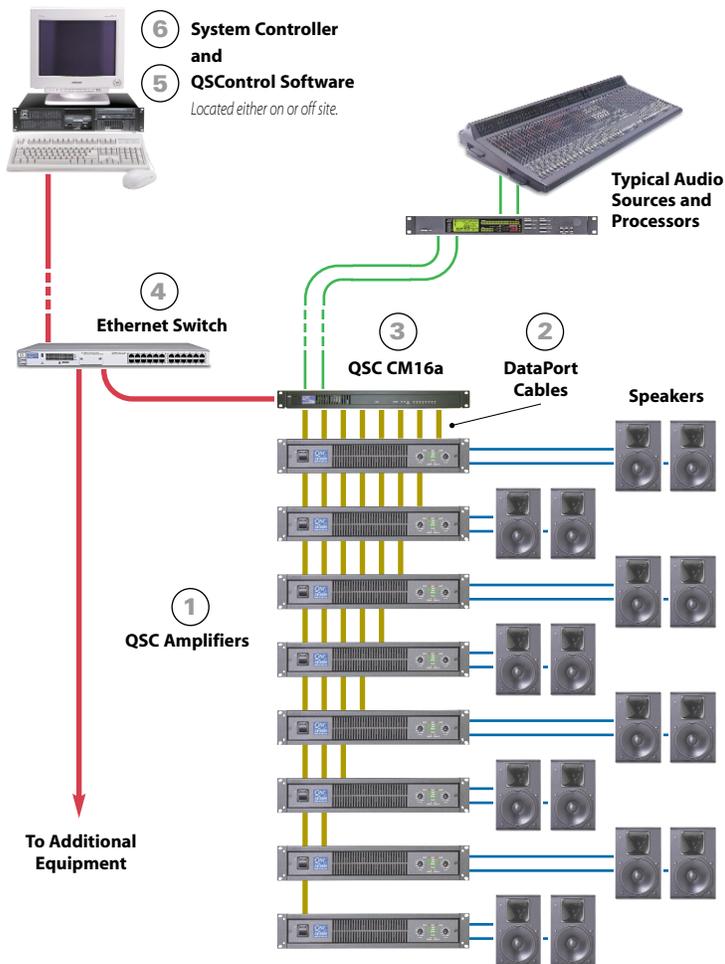# QSControl

Network Audio Systems

QSControl (pronounced Q's Control) is a powerful and flexible system that provides remote management and diagnostics of QSC amplifiers and other audio devices over an Ethernet network—including selected QSC DSP devices, such as the DSP-3 digital signal processor. You can monitor and control hundreds of amplifiers simultaneously, as well as perform a wide range of advanced functions, including event logging, real-time monitoring of loudspeaker opens and shorts, plus configuration of the DSP-3 module.

A QSControl system is composed of a System Controller (a Microsoft Windows-based PC) running QSControl Software that is linked via Ethernet to CM16a Amplifier Network Monitors or other networked audio devices. Each CM16a provides sixteen channels of remote level adjustment and amplifier management for DataPort-equipped QSC amplifiers.

6 **System Controller**
and
5 **QSControl Software**
Located either on or off site.

Typical Audio Sources and Processors

4 **Ethernet Switch**

3 **QSC CM16a**

2 **DataPort Cables**

Speakers

1 **QSC Amplifiers**

To Additional Equipment

Key Components of QSControl

CM16a Amplifier Network Monitor

The CM16a Amplifier Network Monitor ③ offers powerful amplifier management in a QSControl networked audio system, using Ethernet ④ technology to communicate with the host system controller. The System Controller ⑥ uses application software ⑤ to operate the networked audio system, including the CM16a units and their amplifiers ①.

Each CM16a performs monitoring and control functions for QSC DataPort-equipped amplifiers using DataPort cables ②. Further, the CM16a connects to QSC's family of digital signal processors such as the DSP-3.

Control Application Software

There are two ways to run QSControl applications on the System Controller. The first is with System Manager, QSC's standard application included with the QSControl system, requiring no user programming. The second is to create a custom application using the QSControl Development Tools in Microsoft Visual Basic. Using these tools, the system can be customized to your specifications.

System Controller

QSControl Software runs on a computer configured with select Microsoft operating systems—including Windows® 2000. The Graphical User Interface (GUI) program controls QSC's and third-party networking products.

QSControl Amplifier Network Monitor

CM16a

The CM16a Amplifier Network Monitor is a key hardware component of QSControl, QSC's Ethernet-based audio network. Each CM16a provides sixteen channels of audio level control, monitoring, and amplifier management for DataPort-equipped QSC amplifiers. The CM16a is operated remotely by a Windows-based PC functioning as the System Controller running QSControl application software. Control and monitor data is communicated between the System Controller and CM16a over an Ethernet network. The CM16a, located in the amplifier rack, is linked to amplifiers via DataPort cables. The CM16a also serves as the network interface for QSC's digital signal processors, including the DSP-3.

Input / Output Control and Monitoring

- Input sensitivity selection: 1V or 3V
- Input source select: Normal/Page
- Level control
- Pre-/Post-fader audio signal monitoring
- Mute control
- Signal polarity control
- Pre-/Post-fader signal level metering

Amplifier Output Monitoring

- Output voltage and current metering
- Output power in watts
- Output clip detection monitoring
- Headroom metering
- Output signal (speaker terminal) audio monitoring

Load Monitoring

- Open/shorted load detection
- Adjustable threshold for detecting load opens and shorts
- Continuously updated average impedance measurement

Amplifier Management

- AC standby/operate mode selection
- AC mode indication (Off/Standby/On)
- Protect status monitoring
- Operating temperature metering
- Overtemp indicator with adjustable overtemp threshold
- Gain control monitoring
- Model ID indication
- Bridge Mono/Parallel/Stereo mode indication

Other Features

- Fifteen user-definable configuration presets
- RS-232 port for diagnostics and preset control
- Internal sine wave signal generator available for system diagnostics (accessible via Telenet only)
- Page input with selectable 1V or 3V sensitivity
- One contact closure input
- One floating dry-contact SPDT (Single Pole Double Throw) relay output
- Audio monitor bus with selectable tap points, mixing, and balanced I/O
- Recessed front panel bypass switch
- Firmware is updateable via the network to add future upgrades

Mandalay Bay Resort, Las Vegas

Petronas Towers, Malaysia

Heinz Field, Pittsburgh

Miller Park, Milwaukee

The Galaxy Theater, California

Specifications

Input Signal

Frequency Response
20 Hz to 20 kHz, ±0.5 dB
10 Hz to 80 kHz, ±3 dB

Distortion
<0.01% THD+N @ +4 dBu out
(page input <0.03%)

Dynamic Range
>110 dB unweighted (20 Hz–20 kHz)
(page input >100 dB)

Polarity
In-phase or reversed

Level Control Range
-95.5 to 0 dB in 0.5 dB steps

**Precision Attenuator Transients
("zipper noise")**
better than 112 dB below maximum output

Mute
>90 dB attenuation

Inputs

Program inputs	16	
Paging input	1	Dedicated input with configurable routing to any or all 16 input sections
Monitor bus input	1	
Connector type	"Phoenix-style" (a.k.a. "Euro-style") detachable terminal blocks	
Type	Electronically balanced	
Grounding	All shield terminals connected to chassis	
Nominal level	1V/3V rms selectable (-10 dBV/+4 dBu)	
Maximum level	+21 dBu	
Impedance	25 kΩ balanced	
Common-mode rejection	Typical, >50 dB, 20 Hz-20 kHz	
	Worst Case, >40 dB at 20 kHz	
Crosstalk (inter-channel within DataPort pair)	>75 dB separation (20 Hz–20 kHz)	
Crosstalk (intra-channel between DataPorts)	>90 dB separation, 20 Hz-20 kHz measured with all inputs and outputs terminated	

Outputs

Program outputs	16 (via HD-15)
Connector type	8 HD-15 DataPort connections
Cable type	VGA monitor cable [1]
Qualified length	2 meters
Monitor output	1
Connector	"Phoenix-style" (a.k.a. "Euro-style") detachable terminal blocks
Type	Electronically balanced
Grounding	Shield terminal connected to chassis
Nominal level	+4 dBu
Maximum level	+21 dBu
Output impedance	75Ω balanced
Output load	600Ω min

Power Amplifier Output Monitoring

Output Short Detect*
Senses load <1Ω for Stereo/Parallel modes;
<2Ω Bridge Mono mode (default threshold)
Threshold is adjustable in software

Output Open Detect*
Senses load >60Ω (default threshold)
Threshold is adjustable in software

Output Voltage Meter
Range automatically matches to
amplifier model used

Output Current Meter
Range automatically matches to
amplifier model used

Amplifier Headroom
Reports remaining available power

Amplifier Gain*
Calculates and reports amplifier gain
(knob setting)

Signal level must be higher than -32 dB, referenced to maximum output of amplifier

Power Amplifier Management

Power Amplifier Interface

Compatibility	QSC DataPort-equipped amplifiers
Connector and cable	HD-15 VGA cable [1], 2 meters length [2] qualified (for longer runs, contact QSC's Technical Services Department)

Amplifiers
Up to 16 channels (8 DataPorts) of
QSC DataPort-equipped amplifiers

Amplifier AC Power Control

AC mode control	Switches amplifier between operate and standby mode
AC power indicator	Indicates operate, standby, or power-down mode

Amplifier Status Monitor

Clip indicator	Senses channel clip status
Protect indicator	Senses amplifier protect status
Temperature meter	Reports amplifier operating temperature
Over-temp. alert	Software adjustable threshold (80°C default)

Control Room Foldback Monitoring

**Number of Signal
Monitoring Buses per CM16a**   1

Number of Channels per CM16a   4   (Maximum number assigned to monitor mix at one time)

**Internal Signal Monitor Points
(each with individual level controls)**

Pre-fader input signal	16
Post-fader input signal	16
Power amplifier output	16

Monitor Input
Summed with internal monitor mix
at unity gain

Monitor in to monitor out	0 dB, ±1 dB
Nominal level	+4 dBu
Maximum level	+21 dBu
Input impedance	10kΩ balanced
Configuration	Active balanced, shield connected to chassis
Common-mode rejection	Worst case, >54 dB at 20 Hz rolling off to >40 dB at 20 kHz
	Typical case, >50 dB 20 Hz-20 kHz

Output
Sum of external monitor input and signals
from internal monitor mix

Frequency response	20 Hz–20 kHz, ± 0.5 dB
Distortion	<.05% THD @ +4 dBu out
Dynamic range	>90.5 dB unweighted, 22 Hz–22 kHz
Noise floor	-90.5 dB
Nominal level	+4 dBu
Maximum level	+21 dBu
Output impedance	75Ω balanced
Output load	600Ω min
Configuration	Active balanced

RS-232 Port

Cable Type
Null-Modem (a.k.a. Laplink), female 9-pin
D-sub chassis connector

Port Settings

Bits per Second	9600
Data Bits	8
Parity	none
Stop Bits	1
Flow Control	Xon/Xoff

Contact Closure Inputs and Outputs

Inputs	1 discrete input
Configuration	Single-ended input
Resistance for closure detect	< 1kΩ max
Resistance for open detect	> 5kΩ min
Input voltage limit	7.000 VDC maximum
	("-" input terminal connected to chassis)
Output	1 discrete output
Configuration	Electromechanical relay, dry contacts,
	floating, C, NC, NO
Maximum steady-state current	0.5A
Maximum switched current	0.25A
Ground isolation	70V maximum
Connector	"Phoenix-style" (a.k.a. "Euro-style")
	detachable terminal block connectors

Network Interface

Physical Network	Ethernet
Raw data rate	10 megabits per second
Frame format	D.I.X. (Ethernet)
Connector	RJ-45 female
Ethernet type	10BASE-T: (via RJ-45)
Cable type	10BASE-T: CAT-3 (or better) twisted pair
Max cable length	10BASE-T: 100 m to hub
Grounding	Floating
Transport Network	TCP/IP
Internetwork protocol	IP
Transport protocol	UDP
Application Protocol	QSC24
Version	1
Revision	7

General

Physical	
Height	1.72" (1RU)
Width	19" (standard rack mount)
Depth	14.84" (37.7 cm), including rear supports
Weight	11 lbs. (5 kg)
Mounting	Rear support recommended for portable
	or mobile use
Operating Temp.	0 to 50° C
AC Power	
Voltage	100-240 VAC (Universal Supply)
Current	1A RMS @ 120V, 1.1A RMS @ 100V,
	0.5A RMS @ 230V
Frequency	47–440 Hz

Specifications subject to change.

[1] QSC DataPort cable required for connection with QSC DSP devices.
[2] For lengths greater than 2 meters, a QSC DataPort cable is recommended.

The CM16a Amplifier Network Monitor shall provide input, output, status monitoring, and control for DataPort equipped QSC power amplifiers in an Ethernet-TCP/IP based network audio system. Sixteen independent channels shall be provided, grouped in pairs to support up to sixteen power amplifier channels.

Amplifier Input Control and Monitoring. For each of the sixteen power amplifier input signals, the CM16a shall provide level, mute and polarity control, pre- and post-fader signal level metering and audio monitoring, and selectable +4 dBu/-10 dBV (3V/1V) input sensitivity.

The CM16a shall provide a page input, separate from the normal program inputs, whose signal may preempt the program signal of any or all of the sixteen program channels. This input shall have selectable +4 dBu/-10 dBV (3V/1V) sensitivity.

The CM16a shall provide for the storage and recall of up to sixteen different presets, numbered 0 through 15. Each preset shall be a "snapshot" of all of the CM16a functions and settings. Preset #0 shall be the default boot-up preset.

Amplifier Output Monitoring. For each of the sixteen power amplifier outputs, the CM16a shall provide clip detect monitoring, short/open circuit detect, voltage and current metering, amplifier headroom, load impedance, real output power to load, and audio monitoring of the voltage signal.

Amplifier Management. For each of the DataPort connected power amplifiers, the CM16a shall provide AC standby/operate mode control, AC power state indication, temperature metering, amp gain settings (front panel knob position with respect to full output), over-temperature detection, stereo/parallel/bridge-mono indication, amplifier model detection, and protect status detection (subject to the capabilities of each amplifier).

Audio Monitoring Chain. For each of the sixteen program channels, the CM16a shall provide three monitor points as follows: (1) pre-fader level control, (2) post-fader level control, or (3) power amplifier output. A channel's monitor output may be selected from one of these three signals, or it may be switched off. The signal at the CM16a's monitor output connector shall be the sum of the signal at its monitor input connector and as many as four of the sixteen channel monitor signals at one time per CM16a. A monitor level control shall be provided for each monitor tap point to adjust the individual levels of the channel monitor signals prior to their being mixed with the monitor input signal.

Contact Closure I/O. The CM16a shall provide one trigger contact-closure sense input which shall also be TTL signal compatible, and one dry-contact floating SPDT relay output. These shall be under software control, with functions definable by the QSControl custom software application. The contact closure sense input shall be capable of toggling between presets 14 and 15, regardless of the computer's connection status.

Data Network. All CM16a functions shall be controlled and monitored via an Ethernet digital control network using the TCP/IP transport protocol and the QSC-24 control and monitoring application protocol. Rear-panel connections shall be provided for 10BASE-T Ethernet utilizing a standard RJ-45 Unshielded Twisted Pair Category-5 connection. Other than the AC power and bypass switches, the CM16a shall have no manual controls. A 9-pin, "D" subminiature connector shall be provided to allow interfacing to an RS-232 connection. This connector shall be used for CM16a setup, testing, diagnostics, and limited control functions.
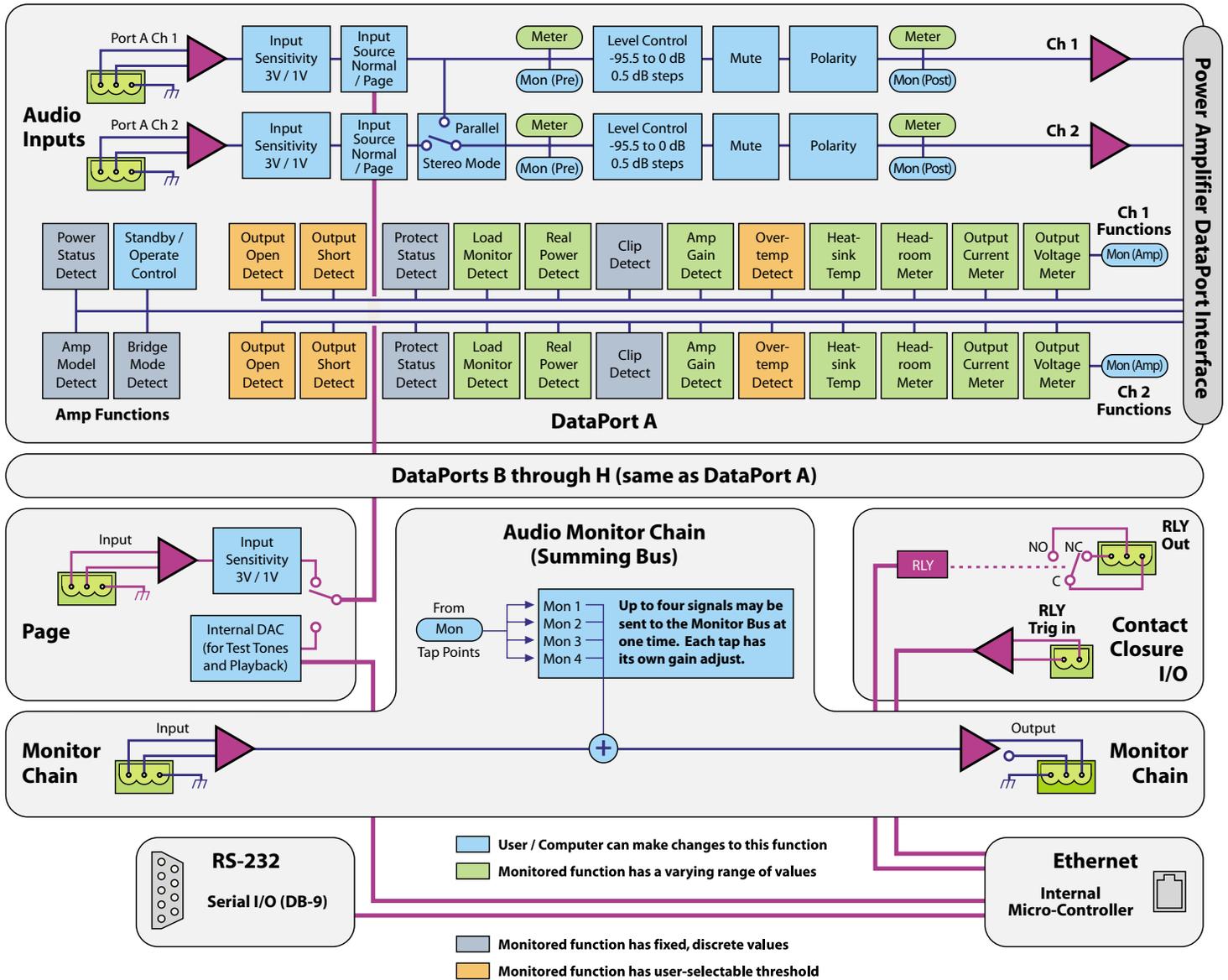
Amplifier Interface. The CM16a's interface to each power amplifier DataPort shall be via a HD-15 connector. The amplifier interface shall use a standard personal computer Video Graphics Adapter (VGA) CRT monitor cable [1]. This interface shall transmit two amplifier input audio signals as well as all control and monitoring signals. Special signal conditioning and grounding techniques shall be used in this interface to ensure negligible levels of noise and crosstalk.

General. All audio inputs and outputs shall be balanced with a nominal input level of +4 dBu and maximum level of +21 dBu. Input connectors shall be of the "Euro-style" depluggable barrier strip type.

QSControl Network Audio Systems

Block Diagram of the CM16a

Audio Inputs

Port A Ch 1 → Input Sensitivity 3V / 1V → Input Source Normal / Page → Meter / Mon (Pre) → Level Control -95.5 to 0 dB 0.5 dB steps → Mute → Polarity → Meter / Mon (Post) → **Ch 1**

Port A Ch 2 → Input Sensitivity 3V / 1V → Input Source Normal / Page → Parallel / Stereo Mode → Meter / Mon (Pre) → Level Control -95.5 to 0 dB 0.5 dB steps → Mute → Polarity → Meter / Mon (Post) → **Ch 2**

Power Amplifier DataPort Interface

Amp Functions: Power Status Detect, Standby / Operate Control, Amp Model Detect, Bridge Mode Detect

DataPort A — **Ch 1 Functions / Ch 2 Functions:** Output Open Detect, Output Short Detect, Protect Status Detect, Load Monitor Detect, Real Power Detect, Clip Detect, Amp Gain Detect, Over-temp Detect, Heat-sink Temp, Head-room Meter, Output Current Meter, Output Voltage Meter, Mon (Amp)

DataPorts B through H (same as DataPort A)

Page
Input → Input Sensitivity 3V / 1V
Internal DAC (for Test Tones and Playback)

Audio Monitor Chain (Summing Bus)
From Mon / Tap Points → Mon 1, Mon 2, Mon 3, Mon 4
Up to four signals may be sent to the Monitor Bus at one time. Each tap has its own gain adjust.

Contact Closure I/O
RLY Out — NO, NC, C
RLY Trig in

Monitor Chain
Input → → + → Output → **Monitor Chain**

RS-232 Serial I/O (DB-9)

☐ User / Computer can make changes to this function
☐ Monitored function has a varying range of values
☐ Monitored function has fixed, discrete values
☐ Monitored function has user-selectable threshold

Ethernet
Internal Micro-Controller

Minimum Recommended Specifications for the System Controller

Processor	866 MHz Intel Pentium™ III processor
RAM	128 MB, 133 MHz bus
Hard Disk	4 GB or greater Ultra DMA
Floppy	3.5" 1.44 MB drive
CD-Rom	40x or greater IDE
Network	10/100BASE-T
Network Configuration	TCP/IP host
Modem	56k V.90 internal PCI (optional)
Video	2D/3D Graphics, 133/100 MHz, 4 MB Display cache or better
Sound	Sound Blaster® compatible (optional)
Keyboard	104 key, PS/2 compatible
Mouse	PS/2 compatible
Operating System	Windows NT-4 (SP-6) or Windows 2000 (SP-2)

All specifications are subject to change.

QSControl Software allows you to view and adjust signal controls with the click of a mouse. You can use System Manager, a standard application included with QSControl Software, or design a custom application tailored to your specific needs with easy-to-use Visual Basic.

QSControl Software significantly expands the system's overall capabilities. Users can now create custom applications with "drag-and-drop" programming, minimizing the need to write code. In addition to amplifier management, users can control additional audio components including MIDI devices. A QSControl system can also be accessed and controlled by multiple System Controllers from multiple locations.

The software supports the CM16a Amplifier Network Monitor, a 1RU unit that links the PC to networked QSC amplifiers to provide remote control and monitoring functions. The CM16a enables QSControl's amplifier monitoring functions by allowing users to adjust thresholds for detecting load opens and shorts, monitor average load impedance, monitor amplifier output in watts, and view amplifier headroom. The CM16a supports all QSC DataPort-equipped amplifiers, including the 4- and 8-channel models. The QSControl architecture supports network communications of QSC's digital signal processors, such as the DSP-3, via CM16a DataPorts. Users can also apply future CM16a firmware updates quickly and easily from a remote PC via Ethernet.

System Manager

System Manager requires no programming whatsoever to operate the system. You can perform comprehensive signal metering and gain adjustment for each amplifier:

- Adjust input sensitivity for 3-volts or 1-volt
- Adjust input levels to the amplifier
- Meter pre-fader and post-fader levels
- Invert the signal polarity
- Override each channel with an auxiliary input that can be used for emergency paging
- Fold back audio to the front-of-house or control position from selectable points in the audio chain: pre-fader, post-fader, or the amplifier output
- Up to sixteen configuration presets can be recalled automatically

You can also perform comprehensive amplifier management:

- Control amplifier power state (On/Standby)
- Monitor amplifier status including clip, protect, and operating temperature
- Monitor amplifier output including voltage, current, power in watts, and headroom
- Load status, including average load resistance and adjustable thresholds for detecting loudspeaker opens and shorts
- Amplifier configuration, including gain control settings and stereo, parallel, or bridge mode
- Monitor amplifier's power status and AC standby mode

System Manager also provides an Event Log that allows you to keep track of system events such as amplifier clipping, protect modes, loudspeaker opens and shorts, and other conditions. These text files can be saved for future reference or downloaded remotely via modem. When any event occurs, System Manager automatically notifies you with a flashing icon.

Custom Applications

Operate QSControl with System Manager, our standard control application included with QSControl Software, or create a custom application to meet your specific needs. Using standard Windows tools such as ActiveX, COM, and plug-in components for Microsoft Visual Basic, QSControl offers the most user-friendly and advanced development tools available today.

QSControl's "open architecture" also allows the control of other manufacturer's devices using RS-232, MIDI, Ethernet, or other interfaces for a single integrated solution using standard development tools such as Microsoft Visual Basic.
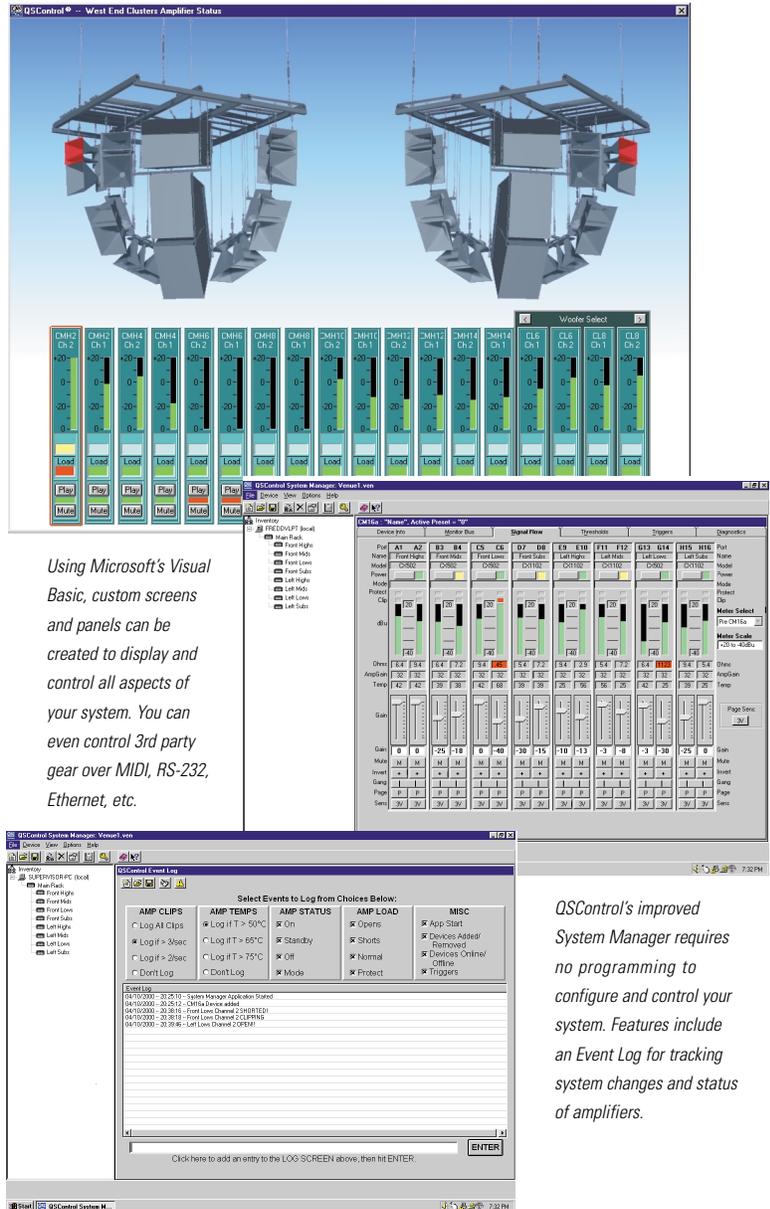
Using Microsoft's Visual Basic, custom screens and panels can be created to display and control all aspects of your system. You can even control 3rd party gear over MIDI, RS-232, Ethernet, etc.

QSControl's improved System Manager requires no programming to configure and control your system. Features include an Event Log for tracking system changes and status of amplifiers.

Benefits of a Custom Application

- Build simple control screens that can perform complex functions.
- Create a full range of system-wide presets that are available for different operating modes in multipurpose venues.
- Perform pre-programmed functions at designated times—without an operator present. For example, perform basic diagnostic checks at night, log the results, and power the system down.
- Control non-QSC equipment via Ethernet, MIDI, contact closures, RS-232 or other interfaces for a single integrated solution.
- Automate performance monitoring and maintenance. For example, alert the operator whenever a loudspeaker circuit becomes open or shorted, mute the power amplifier, and log an error message for maintenance personnel.
- Provide a comprehensive set of fire and emergency mode functions that are invoked by an external contact closure or other simple signal.
- Employ full, multi-level password security, allowing only authorized personnel access to certain control functions.